Seminar on hot topics in mobile computing (II)

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Outline

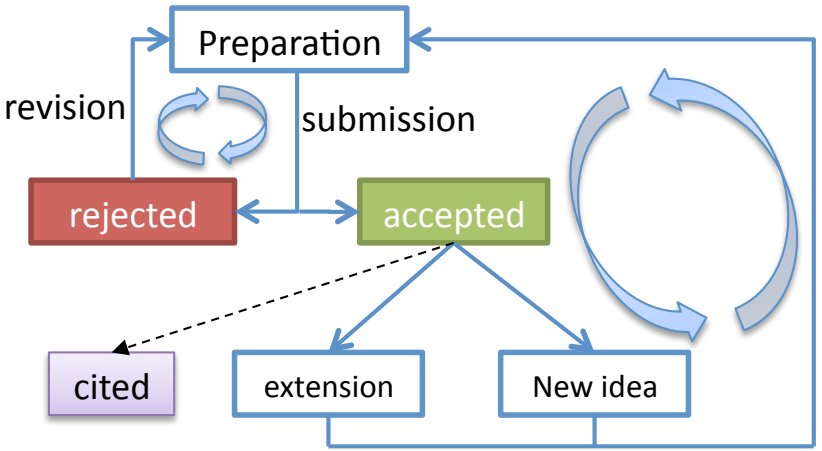
- How to read and write research papers ?
- Overview of mobile content networks
- **T1**: Searching
- **T2**: Caching/Replication
- **T3**: Multicast/Dissemination
- **T4**: Routing
- Conclusion

Reading and Writing research papers ?

- Reading is relatively straightforward
- Why authors wrote the paper? Motivation
- Why reviewers accepted one paper?
  - ✓ Contributions (50%)
  - ✓ Presentations (30%)
  - ✓ Good Luck (20%)
- Why our readers need to read this paper? Learning the proposed problem and its solution) and Writing

Thinking & Asking **why**?

- Writing is relatively difficult
  - Prepare the idea
  - Writing the details
  - Implement the algorithm
  - Test and Experiments
- Paper Cycles



Best Case: 3-4 months of Paper Preparation
+ 3-4 months of review and then accepted.

Some Interesting Reference

- **How to read a research paper :**

Learning
  - Read critically involves asking appropriate questions.
    - Are the assumptions the authors make reasonable?
    - The proposed problem makes sense?
    - The proposed solution is clear and reasonable?
    - The experiment metric/approach/testbed is correct?

Thinking
  - Read creatively involves harder, more positive thinking.
    - What are the good/cool ideas in this paper?
    - Do these ideas have other applications or extensions that the authors might not have thought of?
    - Can they be generalized further, and extended?
    - Are there possible improvements?
    - If you were going to start doing research from this paper, what would be the next thing you would do?

Writing
  - Make notes and Summarization
  - Yourself can re-implement the proposed approach and algorithm.
  - Compare with other works (→reorganizing your idea)

Refer to http://www.eecs.harvard.edu/~michaelm/postscripts/ReadPaper.pdf

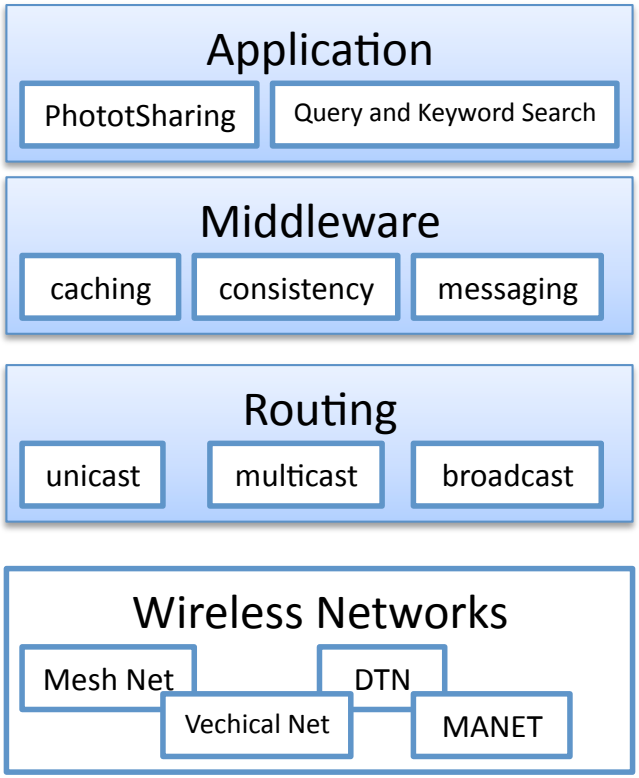
How could we write a seminar paper?

- Latex editor (e.g., LexMaker) , IEEE Transaction Format (6-7 pages)
- Content (two main parts)
  1. Briefly introduciton of the paper that you are reading (this is the learning part): at most 4 papes with clear and simple sentences (ensuring others can understand what your are talking about).
     - The proposed problem, challenges, contributions
     - The proposed solution, and algorithm
     - Testing Environment, metric, compititors, and results.
  2. Your own thinking part (at least 2-3 pages)
     - Which (cool) idea is what you most likely interested in? Why?
     - If you wan to extend/improve this proposed solution/algorithm, how to do?
     - Is there any other literature work which also solves this problem? If having, what's the comparsion? What's the advantages and disvantage?
     - If you want to re-implement and repeat the experiments, how to do? And what's the most difficult points you will meet?
  3. If any student re-implements the algorithm and demonstrates the prototype, you will get full marks of this course!

copy & paste is prohibited!

Do NOT steal others' idea!

Overview of Mobile Content Networks



T1: Searching

T2: Caching

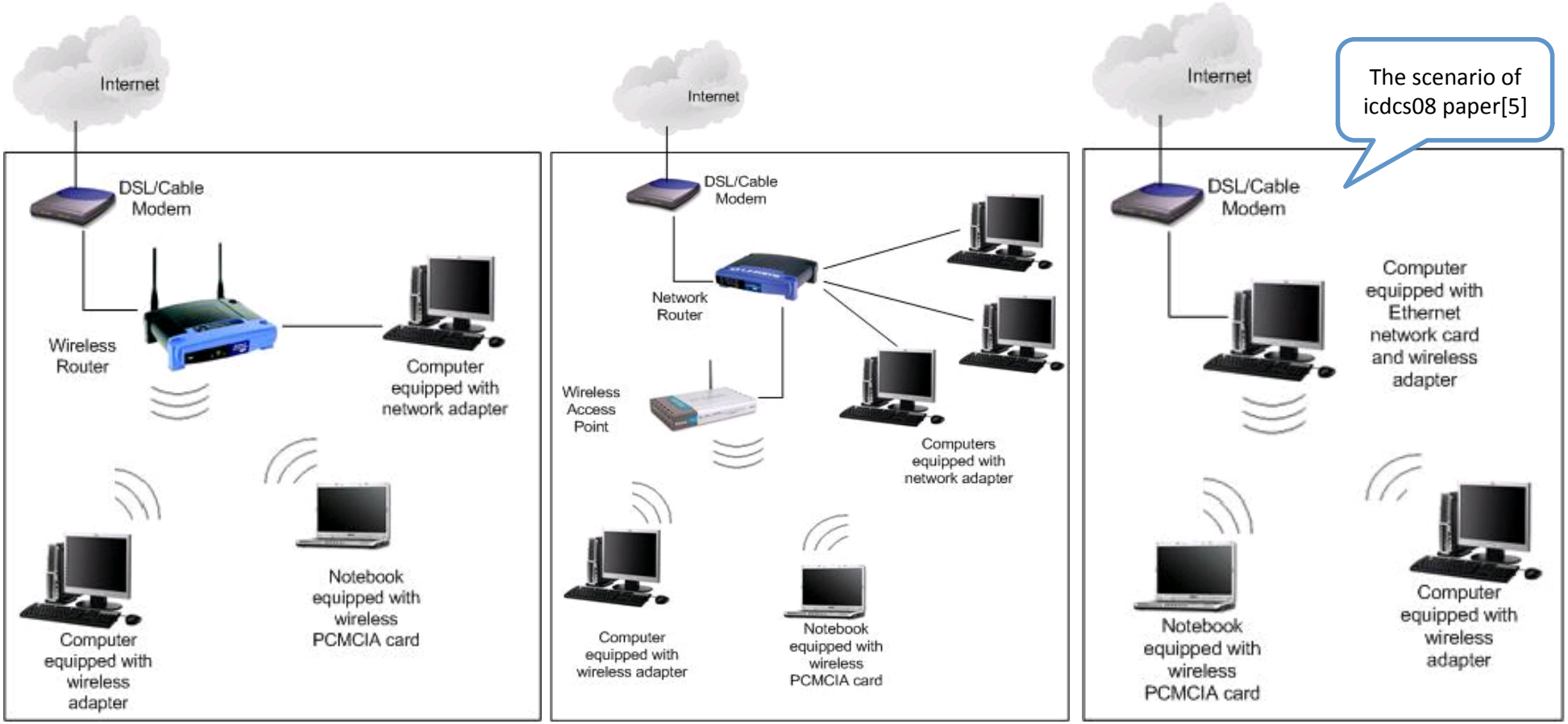
T3: Dissemination

T4: Routing

- Data/Content is the first-class citizen.
- It decides the design principle and mechanism.
- New apps and content offer both challenges and opportunities.

Wireless LAN

The IEEE 802.11 standards specify two operating modes: **infrastructure mode** and **ad hoc mode**.



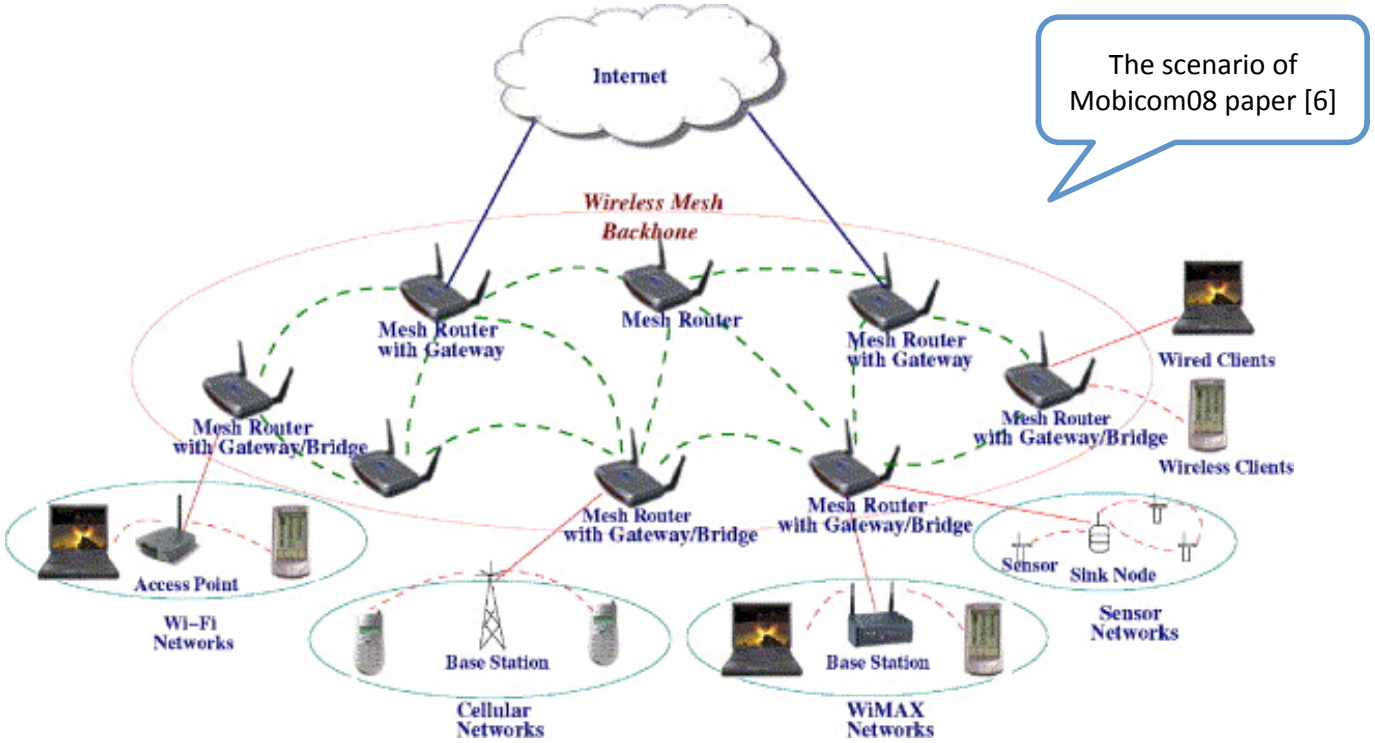
Wireless Routers + Wireless Client

Wireless Routers/AP + Wireless Client

Ad-Hoc comm. Between Wireless Clients

Copied from http://www.home-network-help.com/wireless-network.html

Wireless Mesh Network (WMN)



1. A wireless mesh network (WMN) comprises wireless routers that together form a network backbone to provide Internet connectivity for mobile/fixed hosts.
2. WMNs are used in scenarios when a wired backbone is unavailable or prohibitively expensive.
3. Compared to wireless LAN hotspots and cellular networks, the access points/routers in a WMN do not require wired network connectivity
   - they forward traffic wirelessly towards a special gateway with (normally wired) connectivity to the Internet.

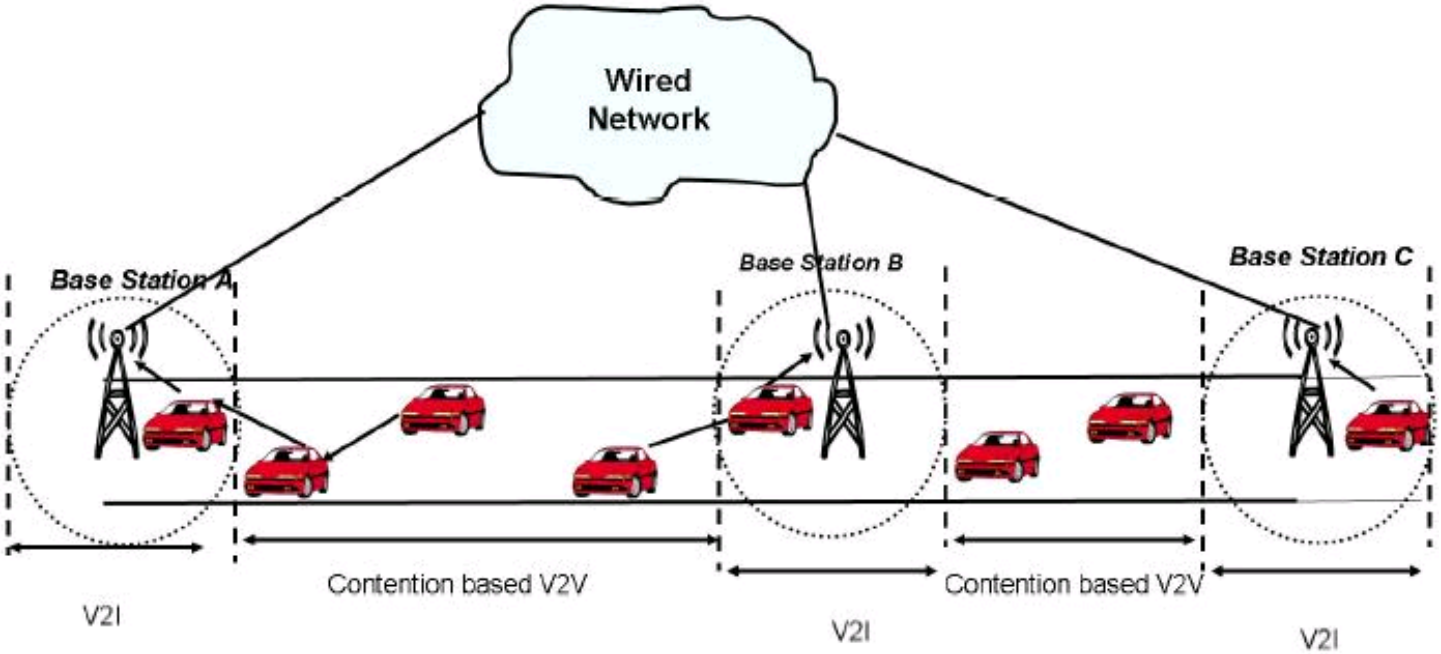
Figure is copied from "Wireless mesh networks: a survey "

Delay Tolerant Networks

- Internet is focusing on the reliable connection in an end-to-end paradigm.
  - Typically we use the graph model to formulate the world of wired networks.
- No good for some kinds of wireless networks, e.g.,
  - The mobility of intermediate nodes → path changes too fast, and the oveahead to maintain the routing informaiton is high
  - The scheduled power outages of some wireless sensor nodes
- The routing must tolerate the long delay.
  - Deep space networks
  - Mobile Ad-Hoc networks
  - Wandering Nodes (e.g., Zebra Nets) http://www.princeton.edu/~mrm/zebranet.html
- Story-carry-forward (Hop-by-Hop Transport)

The scenario of papers [8,10,12,14,15,16]

Inter-Vehicle Networks



The scenario of percom09 paper[11]

Figure is copied from http://www2.ece.ohio-state.edu/~ekici/res_ivc.html

Social Networks

- Online Social Networks
  - Facebook, Digg.com, Twitter, etc.
  - People are connected by the online social networks.
- Mobile Social Networks
  - Mobile phones are carried by people, and People are moving around.
  - Short range communication among mobile devices, e.g., bluebooth.
- Key Parameters:
  - Degree (and closenes/betweeness) centrality
  - http://en.wikipedia.org/wiki/Centrality
  - Help improve the routing efficiency.

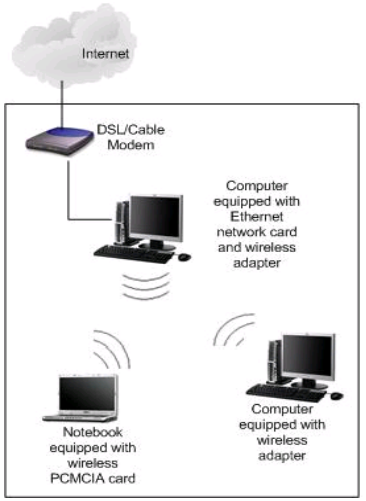
Why? 

The scenario of papers[15,16]

Outlines

- Overview
- **T1**: Caching/Replication
  - On Cooperative Caching in Wireless P2P Networks (ICDCS08) ← our example paper.
  - Ditto: a system for opportunistic caching in multi-hop wireless networks (mobicom08)
  - A survey of data replication techniques for mobile ad hoc network databases (VLDBJ 08)
- **T2**: Searching
  - Searching for Content in Mobile DTNs (percom09)
  - Search-based picture sharing with mobile phones (mobihoc09)
  - SMS-Based Mobile Web Search for Low-End Phones (Mobicom10)
- **T3**: Multicast/Dissemination
  - Content based multicast (CBM) in ad hoc networks (mobihoc00)
  - Persistent Content-based Information Dissemination in Hybrid Vehicular Networks (percom09)
  - Multicasting in Delay Tolerant Networks: A Social Network Perspective (Mobihoc09)
  - Socially-Aware Routing for Publish-Subscribe in Delay-Tolerant Mobile Ad Hoc Networks (jsac08)
- **T4**: Routing
  - Replication Routing in DTNs: A Resource Allocation Approach (sigcomm07)
  - Whirlpool Routing for Mobility(mobicom10)

On Cooperative Caching in Wireless P2P Networks(ICDCS08)



Component that transparently stores data, so that future requests for that data can be served faster (e.g., web caches), know some replacement alg?

A cooperative cache system lets multiple servers cache the to reduce query delays and improve data accessibility. (directory-based, router-based, etc.) . It answers both local requests and remote requests from others.

1. What kind of object information is to be cached? (data or the routing/ location info to access the data, or others?)
2. Among all objects to be cached, which ones should be cached? (replacement alg due to the limited capacity)
3. Given a set of distributed nodes, where (which nodes) are chosen to place the replica?

Cache?

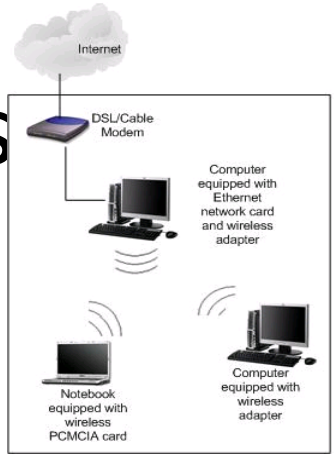
Cooperative Caching?

Cooperative Caching in wired networks?

Cooperative Caching in wired P2P networks?

Cooperative Caching in wireless P2P networks?

On Cooperative Caching in Wireless P2P Networks(ICDCS08)



- An example application (battle field)

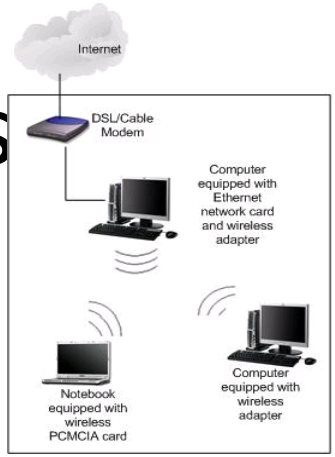
nd time.

Cooperative Caching in wireless P2P networks

These goals differ from wired cooperative cache!

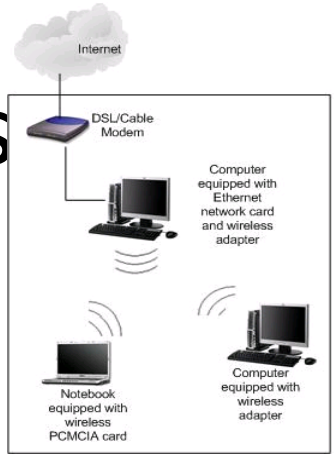
http://www.arms-cool.net/forum/viewthread.php?action=printable&tid=31789

On Cooperative Caching in Wireless P2P Networks(ICDCS08)



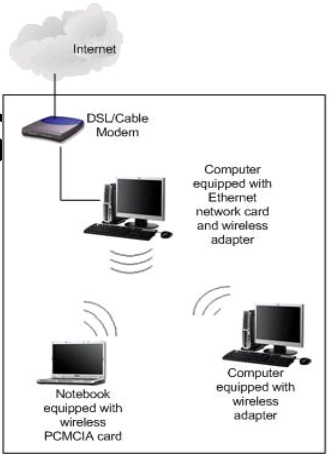
- An example application (battle field)
- A key assumption:
  - All soliders access the same battle information from the commder center, e.g., battle map, etc.
  - Therefore, it offers chances to levaerge the cached content for future requests.
  - It means, if some content is cached, and requested by more users, the hit ratio could be high, and thus the cache system can benefit more from the cached content.
  - Otherwise, if the hight ratio is low, the cached content is useless.

On Cooperative Caching in Wireless P2P Networks(ICDCS08)

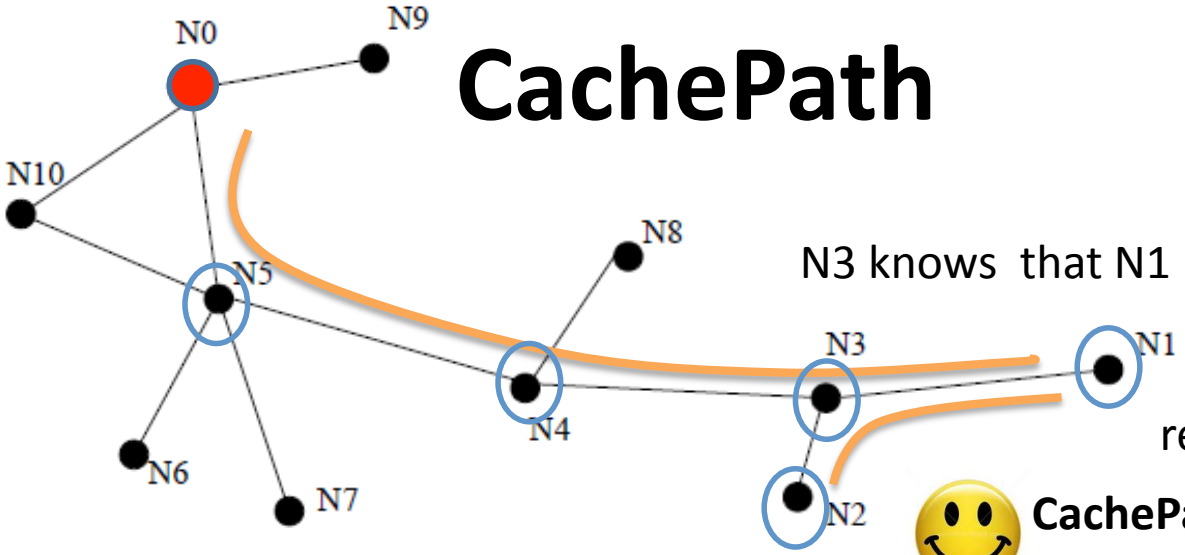


- First work to design and implement the Cooperative Caching in Wireless P2P Networks;
  - Previous works are only based on pure simulation, and implemented only in the Internet and Web environments
- Asymmetric approach to reduce the caching overhead.

On Cooperative Caching in Wireless P2P Networks(ICDCS08)



CachePath



N3 knows that N1 has one of the content

requestor

requestor

Not to cache the path info that N1 has cached the content!
A node only cahces the close path information.

We can formally define a closeness function to formate the distance.

Do you know what we are talking about?

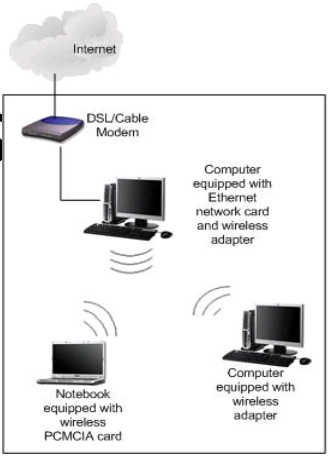
(i) What info to cache and (ii) where to cache the content.

CachePath: caching the data path for each data item can reduce bw & power.

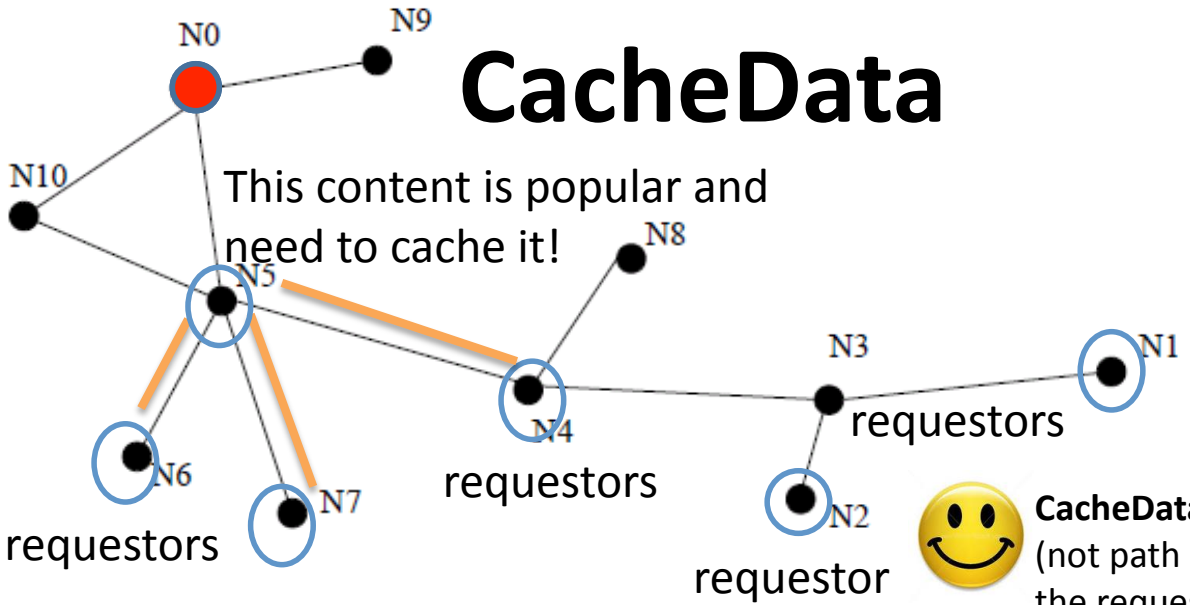
However, mapping data items and caching nodes increases routing overhead

A node only records the data path when it is closer to the caching node than the data source (no need to cache the path information of all passing data)

On Cooperative Caching in Wireless P2P Networks(ICDCS08)



CacheData



CacheData: caching the data (not path Info), and directly answering the request.

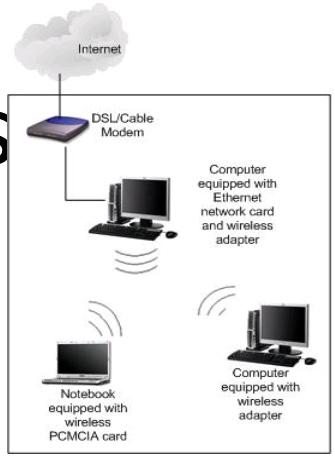
the CacheData approach needs extra space to save the data, it should be used prudently.

All nodes along the path from N0 and N3 want to cache the popular content → huge overhead.

A node does not cache the data if all requests for the data are from the same node.

Now only N3 (neither N4 nor N5) will cache the content because all requests to N5 are from N4, and all requests to N4 are from N3.

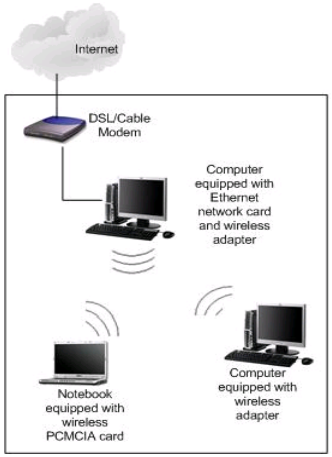
On Cooperative Caching in Wireless P2P Networks(ICDCS08)



	CachePath	CacheData
Cached Info	Mapping between Cached content and caching Node	Cached Data
Overhead	Pairs of <Content, Node>	Space cost for cached content
Ímprovement	Close Path Info	The node which receives the content from different requests
Suitable Scenarios	Good for the cache that is small or data update rate is slow	Good other situations

Hybrid Solution to combine benefits from both approaches;
Need some **criteria** to determine which case is better for either case

On Cooperative Caching in Wireless P2P Networks(ICDCS08)



	ICDCS08 Paper	MobicCom08 Paper
Environments	p2p Wireless Networks	Wireless Mesh Networks
Assumption	Workload locality	Workload locality, overhearing
Caching Mechansim	CachePath, CacheData,Hybrid	On Path Caching, Opportunistic Caching
Contributions	Real implementation → Asynmetric approach →Data Pipeline (reduce e2e delay)	Design,(real) Implement, and evaluate Ditto
Potential Improvement	Cache Placement? Optimal Caching Scheme? Privacy Issue? Any other?	

If you want to present the ICDCS08 and Mobicom08 papers, you need to use your own words and no diretly copy from these slides.

The End

Thank you very much.